



TRAIN THE TRAINER

WEBINAR



CompTIA Network+ N10-009 TTT Session 2:

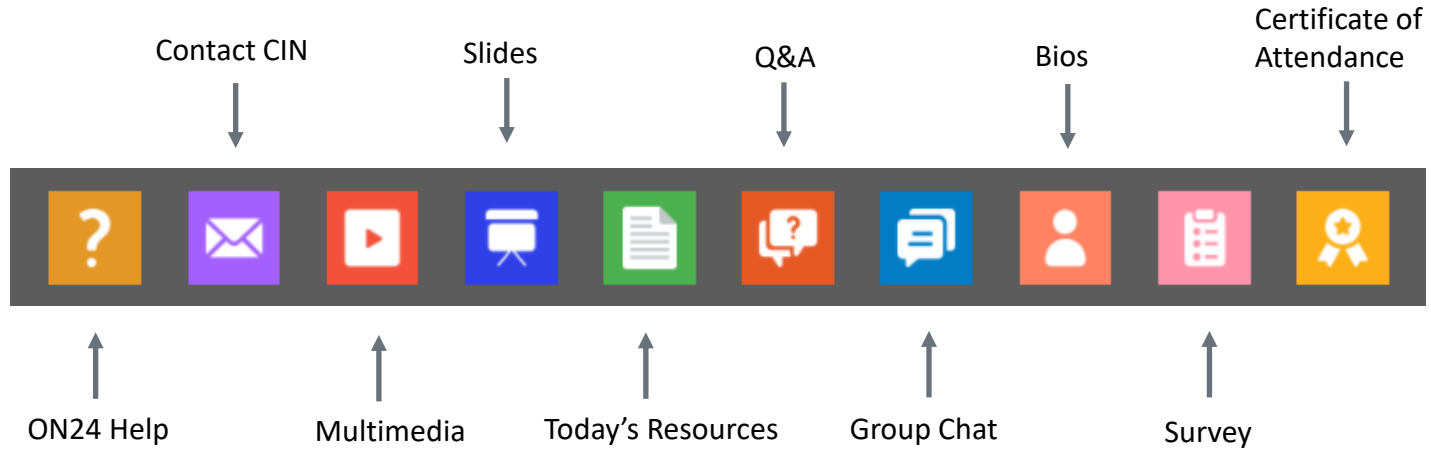
Title

June 20, 2024

CompTIA®



@TeachCompTIA #NetworkPlusTTT



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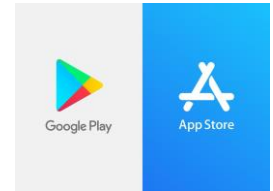
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- Become proficient at teaching CompTIA standards.
- Share best practices and resources with each other.



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Agenda



- Introductions
- Getting to know you
- Why Network+
- Session 2 topics

Network+ N10-009 TTT Session Outline

Date	Topic
✓ 06/20/2024	Introduction and Network Topologies
✓ 06/25/2024	Cabling and Physical Installations
06/27/2024	Configuring Interfaces and Switches
07/02/2024	Configuring Network Addressing
07/09/2024	Configuring Routing and Advanced Switching
07/11/2024	Network Security
07/16/2024	Network Security (Continued)
07/18/2024	Wireless Networking
07/23/2024	Troubleshooting and Management
07/25/2024	Emerging Technologies and Trends

SUPPORTING CABLING & PHYSICAL INSTALLATIONS



Learning Objectives



Summarize Ethernet standards.



Summarize copper cabling and connector types.



Summarize fiber optic cabling and connector types.



Describe physical installation factors for rack-based installations in server rooms and datacenters.



Deploy and troubleshoot Ethernet cabling.

Network Data Transmission Terms

Data transmission is transferring data from one device to another.

Data is sent point-to-point via wired or wireless streams or **channels**.

Digital signals (1s and 0s) are transmitted across the channels.

Transmission media include copper wires, fiber optic cables, or wireless signals.

The speed at which the data is sent is the **data transfer rate**.

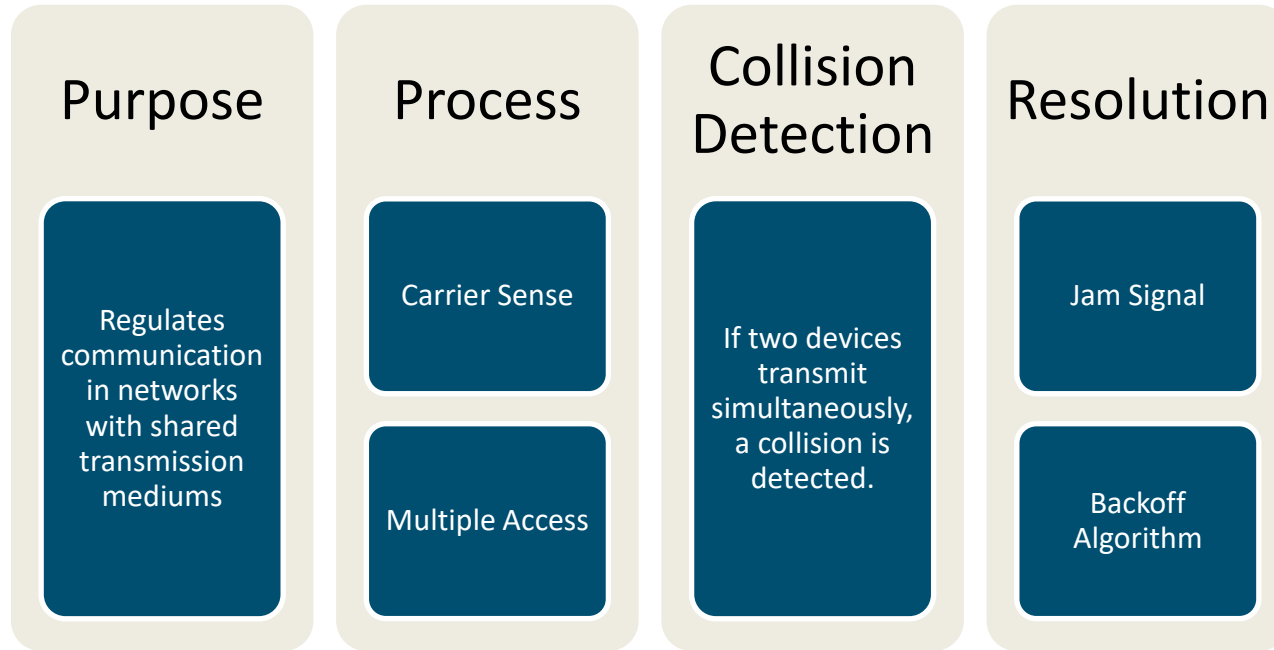
Error detection/correction mechanisms detect transmission errors.

Ethernet Standards

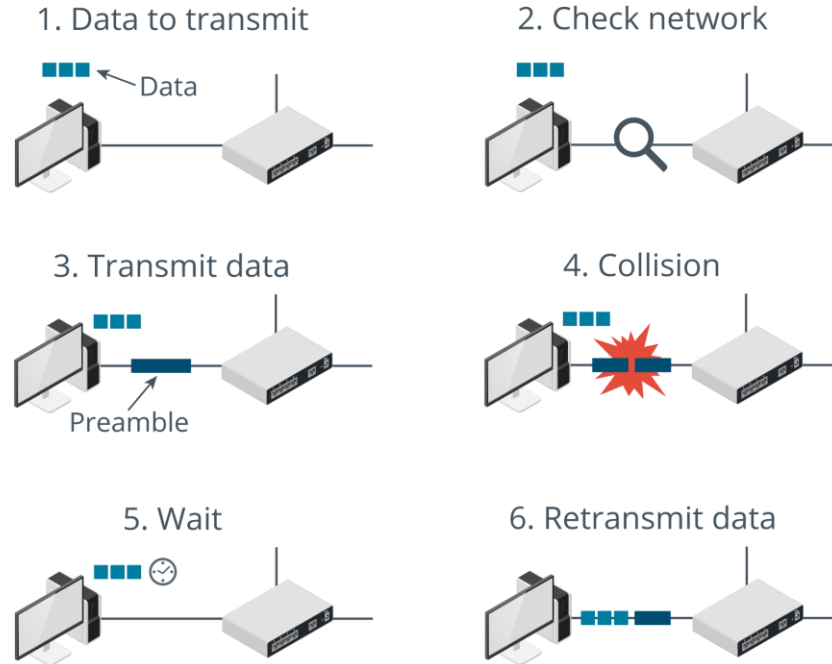
Standard	Cables	Speed
10Base-T	Unshielded twisted pair (UTP)	10 Mbps
100Base-T	Cat5e or higher	100 Mbps
1000Base-T Gigabit Ethernet	Cat6 or higher	1000 Mbps
10GBase-T 10 Gigabit Ethernet	Cat6 or higher	10 Gbps
100Base-TX Fast Ethernet	Cat5 or higher	100 Mbps

- IEEE 802.3 standards define the physical layer and data link layer's media access control (MAC) for wired Ethernet.

Carrier Sense Multiple Access with Collision Detection (CSMA/CD)



CSMA/CD Diagram



Fiber Ethernet Standards

Standard	Cables	Speed
100Base-FX	MMF (OM1)	100 Mbps
100Base-SX	MMF (OM1, OM2)	100 Mbps
1000Base-SX	MMF (OM2, OM3)	1 Gbps
1000Base-LX	MMF (OM1, OM2, OM3), SMF (OS1, OS2)	1 Gbps
10GBase-SR	MMF (OM2, OM3, OM4)	10 Gbps
10GBase-LR	SMF (OS1, OS2)	10 Gbps

COPPER CABLES & CONNECTORS



Unshielded Twisted Pair (UTP)

Structure

- Contains 2 to 1800 pairs in a plastic jacket

Interference

- Minimal EMI protection

Use

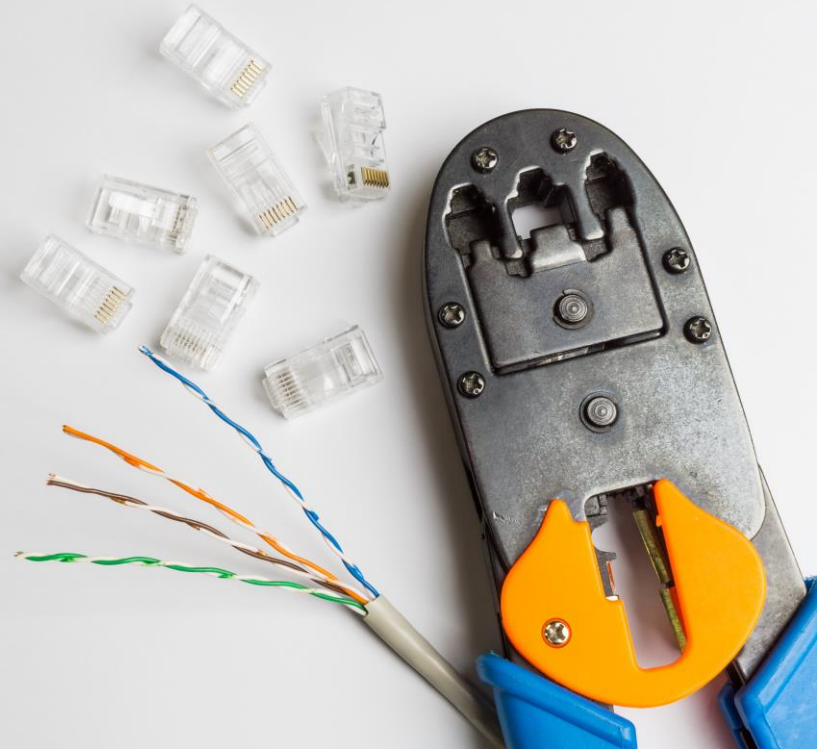
- Popular for LANs because it is cost-effective

Categories

- Grades like Cat5e (1 Gbps) and Cat6a (10 Gbps)

Installation

- Avoid sharp bends, keep away from EMI sources



Shielded Twisted Pair Cable (STP)

Structure

- Twisted copper wires
- Conductive shielding

Interference

- EMI protection
- Reduced crosstalk

Use

- High-interference areas
- Sensitive data transmission

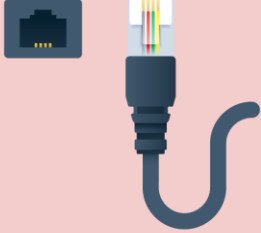
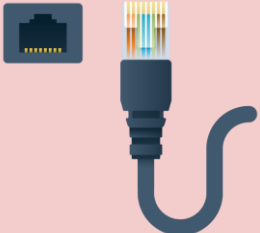
Categories

- Grades such as Cat5e, 6, 7

Installation

- Careful handling
- Avoid sharp bends

Ethernet Connectors

Feature	RJ11	RJ45
Image	 An illustration of an RJ11 connector, which is a small, dark grey plastic plug with four gold-colored pins. It is connected to a blue cable with a white RJ11 plug at the other end.	 An illustration of an RJ45 connector, which is a small, dark grey plastic plug with eight gold-colored pins. It is connected to a blue cable with a white RJ45 plug at the other end.
Configuration	6 positions, 4 connectors	8 positions, 8 connectors
Usage	Phone and modem	Computer networking
Bandwidth	24 Mbps	10 Gbps over Ethernet

Plenum and Riser-Rated Cable

Plenum-rated

Installed in plenum spaces

Made of fire-resistant low toxic materials

Meets higher fire safety standards

More expensive

Riser-rated



Used in vertical spaces between floors

Fire-resistant

Prevent spread of fire between floors

More cost-effective

Coaxial and Twinaxial Cable

Feature	Coaxial	Twinaxial
Image		
Configuration	Central conductor, insulation, metallic shield, outer jacket	Two inner conductors in a twisted pair, insulation, outer jacket
Usage	TV, Internet, radio signals, CCTV	10 GB Ethernet networks
Bandwidth	Wide range of frequencies, high-speed data transmission	Very-short range high-speed
Connectors	BNC, TNC, SMA	Proprietary

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Activity: Multiple Choice



A company is setting up a network in an industrial environment where machinery often causes significant electromagnetic interference. The network requires a cabling solution that can handle high-speed data transfer while also being resistant to this interference. The cable will be used to connect servers within the same data center, and the runs will not exceed 100 meters.

- A. Unshielded Twisted Pair (UTP)
- B. Shielded Twisted Pair (STP)
- C. Coaxial Cable
- D. Fiber Optic Cable

WIRING IMPLEMENTATION



Structured Cabling System

- A structured cabling scheme is a standard way of provisioning cabled networking for computers in an office building.



Work Area

User connection point



Horizontal Cabling

Floor-level networking
Multiple IDFs



Telecommunications Room

Equipment hub
Dedicated space



Backbone Cabling

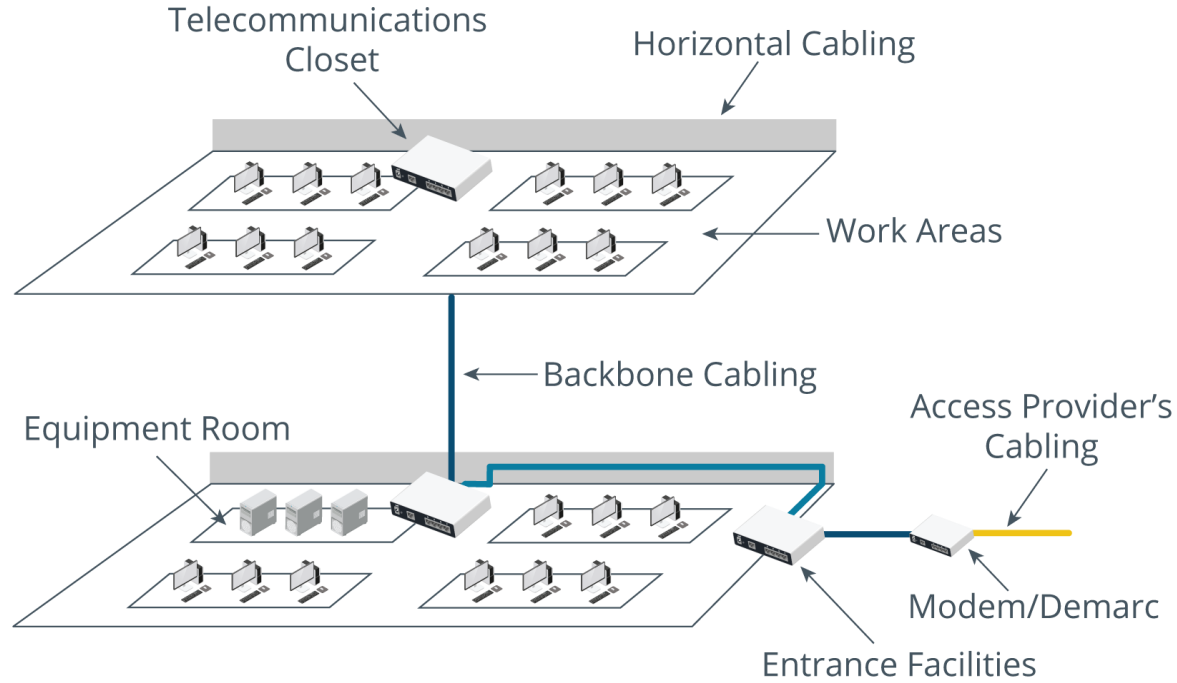
Vertical connections



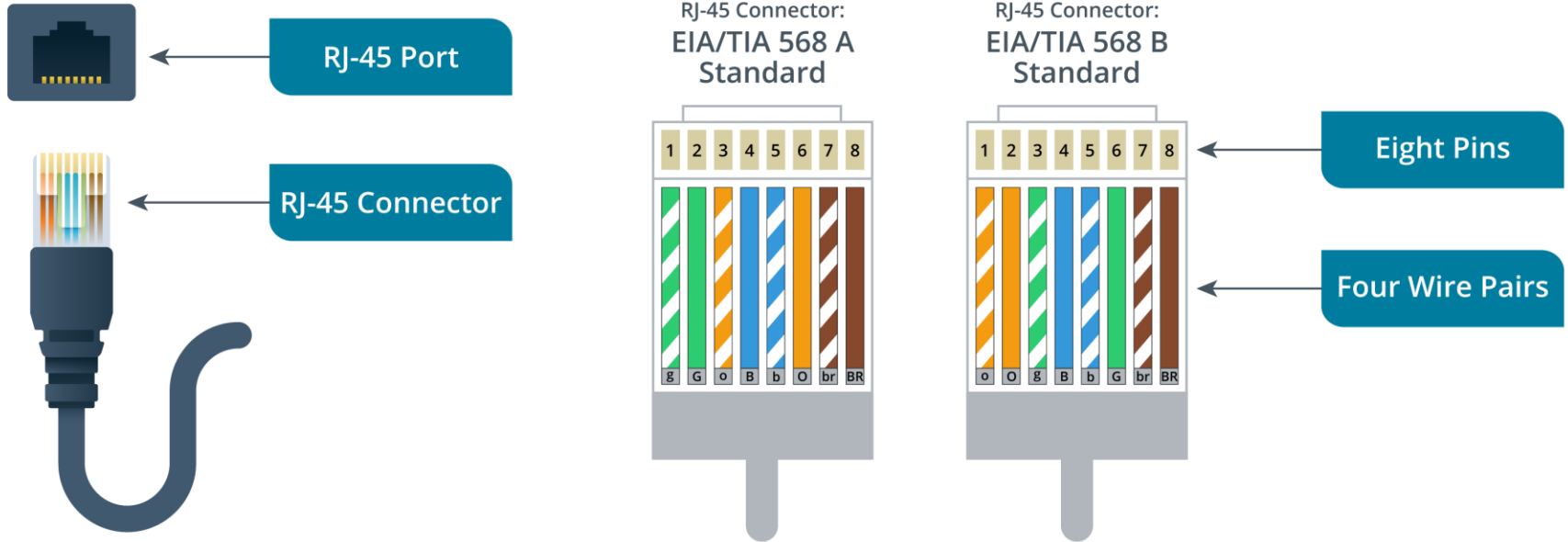
Entrance Facilities/Demarc

Network transition point
LEC integration

Structured Cabling Diagram

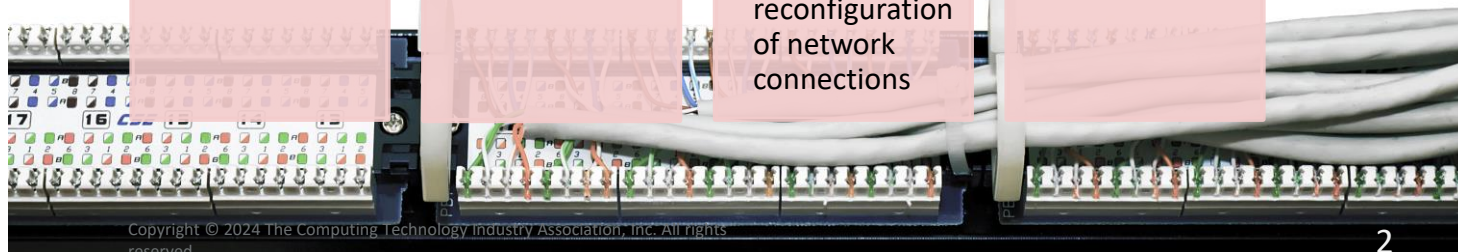


T568A and T568B Termination Standards



Patch Panels

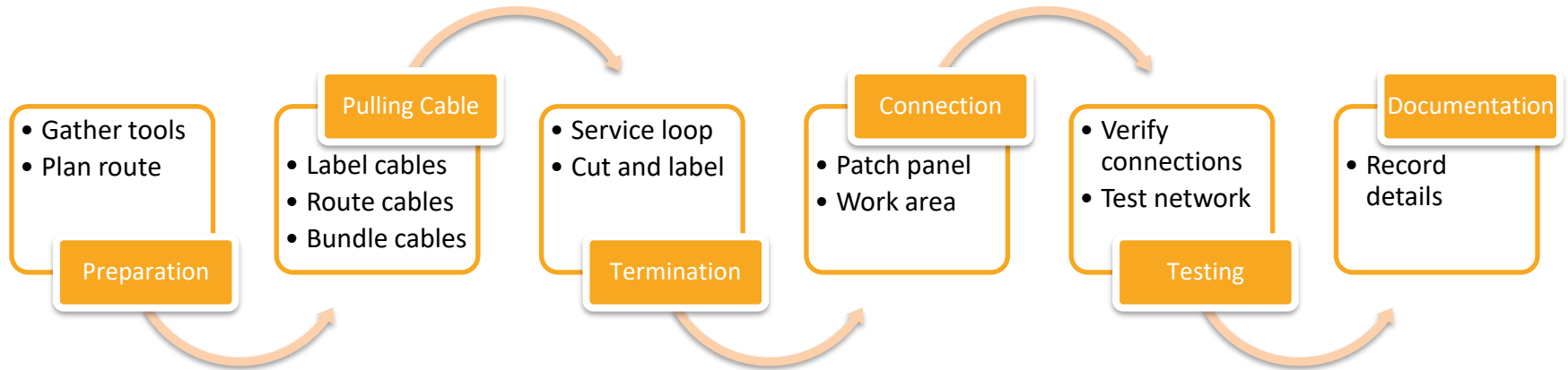
Purpose	Structure	Function	Wiring Standards
<ul style="list-style-type: none">Facilitates cable management	<ul style="list-style-type: none">Punch down blocks at rear for cable terminationRJ45 ports in front for device connections	<ul style="list-style-type: none">IDC terminals allow for secure and compact cable terminationRJ45 ports enable easy reconfiguration of network connections	<ul style="list-style-type: none">Supports T568A wiring schemesSupports T568B wiring schemes



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Structured Cable Installation



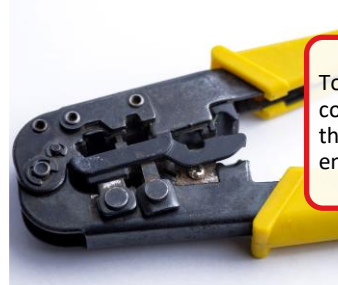
Termination Tools

Cable Cutters



For clean cuts of the cable without damaging wires.

Crimp Tools



To attach connectors to the cable ends.

Punch-Down Tools



For terminating cable wires in punch down blocks.

Cable Strippers



For safely removing insulation without nicking wires.

Activity: What is it?

1



2



3



4



PHYSICAL INSTALLATION FACTORS



Specifications and Limitations: Part One



Understanding Specifications

Compare expected vs. actual performance
Assess speed, throughput, distance



Speed vs. Throughput

Physical Layer: Symbols transmitted, measured in baud rate (Hz)
Data Link Layer: Nominal bit rate or bandwidth (bps)



Throughput Factors

Average data transfer rate over time
Affected by encoding, errors, distance, interference

Specifications and Limitations: Part Two

Measurement Layers

- Network/Transport Layer: Throughput
- Application Layer: Goodput (accounting for packet loss)

Latency

- Speed of packet delivery, measured in milliseconds (ms)
- Also known as latency or delay

Distance Limitations

- Media type dictates bit rate over distance
- Attenuation (dB loss) and interference (SNR) impact performance

Cable Issues: Symptoms

Slow Internet
speeds

Random
disconnections and
reconnections

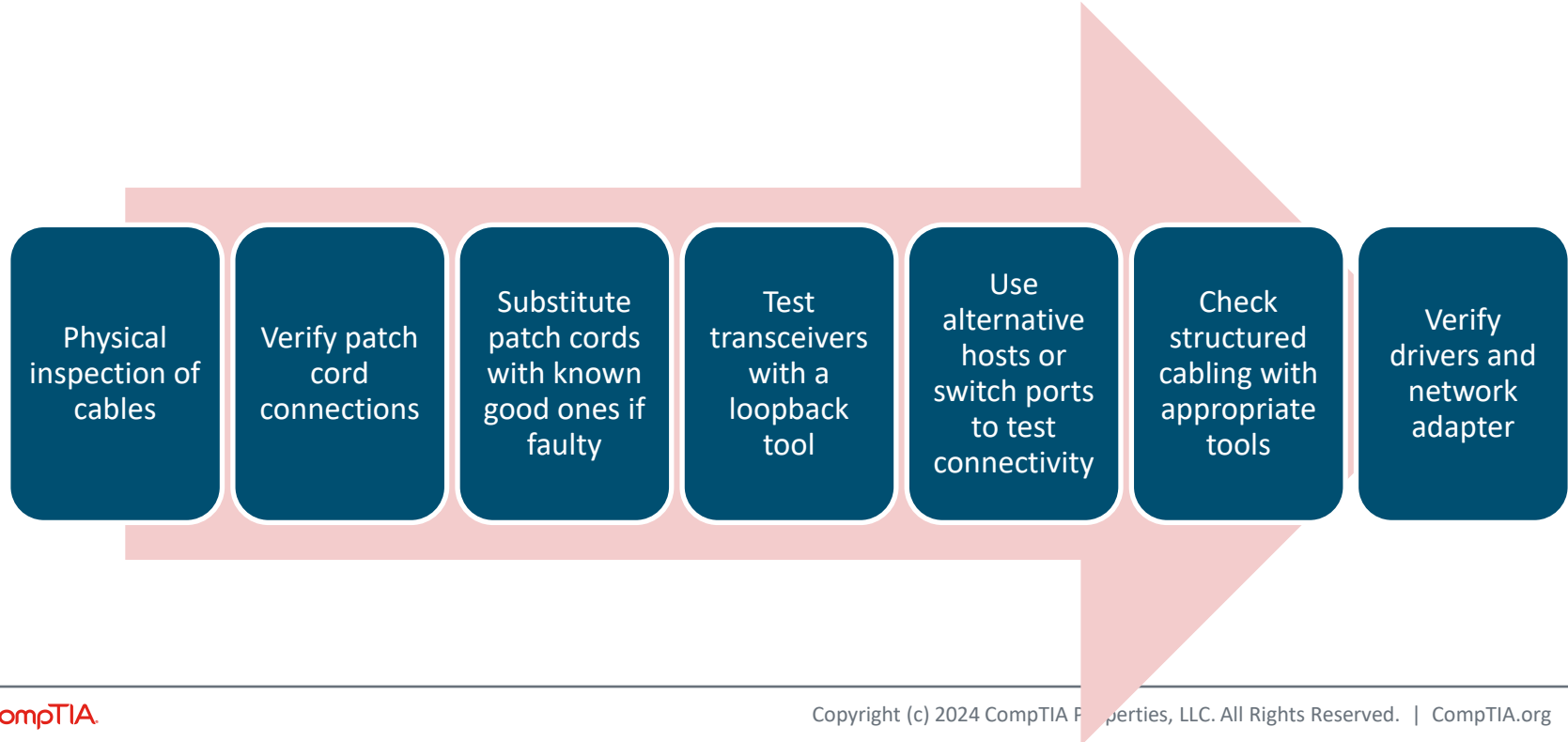
Connection
timeouts

Slowing down
of applications

Lagging
audio/video
communication

Frequent drops
or unstable
network link

Cable Issues: Troubleshooting



Cable Testers

Diagnosis with Cable Testing Tools

- Used when cable is not directly accessible
- Diagnose intermittent connectivity or performance issues

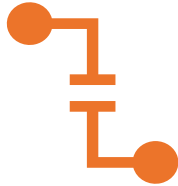
Cable Tester Functions

- Reports on physical and electrical properties
- Tests conditions, crosstalk, attenuation, noise, resistance



3
4

Wire Map Testers and Tone Generators



Wire Map Testers

Detect improper cable termination

Use base and remote units to test each wire conductor

Identify issues like open circuits, shorts, and incorrect pin-outs



Tone Generators

Trace cables through walls or identify active cables in a bundle

Known as “Fox and Hound”

Apply signal to trace cable with a probe

Attenuation Issues

Issues

Signal strength loss during transmission
Higher impedance, higher attenuation
Long cabling distance
Thin wire size
Environmental factors

Solutions

Shorten cable lengths
Use repeaters/extenders
Upgrade to high-quality cables
Measure and test signal attenuation at installation

- Loss of signal strength in networking cables or connections (measured in decibels (dB) or voltage)

Interference Issues

- Negative effects of electromagnetic, radio frequency, and electrostatic signals on cable transmissions

Issues

- Electromagnetic interference (EMI)
- Radio frequency interference (RFI)
- Crosstalk from adjacent wires
- Defective connectors/conductors

Solutions

- Shielding techniques (foil/braided shields)
- Systematic cable routing and organization
- Use robust materials and strain relief
- Compatibility testing

Activity: Think About It



What are some symptoms of cabling issues?

Summary

- **Understand Cable Needs:** Consider factors like interference and attenuation when choosing shielded copper or fiber optic cables
- **Proper Cable Preparation:** Use appropriate tools for cable preparation and termination for connectors or punch down blocks
- **Application-Specific Use:** Ensure cables are used for their intended purpose to meet network requirements.
- **Cable Testing:** Verify cable integrity using appropriate testing tools to identify and troubleshoot faults

Discussion time: Please type your questions in chat

- Questions over content.
- Share you experience.
- What would you like to see different moving forward?

Thank You!



Let's keep the conversation going in the CompTIA Instructor Forum: <https://cin.comptia.org>